

WHAT IS CLAIMED IS:

1. A computer-aided simulation method for determining an electromagnetic field of a body which has a plurality of subregions and contains a plurality of charges and currents, comprising the steps of:

performing, in each of the plurality of subregions, a global multipole expansion, which represents an effect of charges and currents for distant points in a respective subregion of the plurality of subregions in a multipole expansion, and a local multipole expansion, which represents an effect of charges and currents at points inside the respective subregions of the plurality of subregions in a multipole expansion; and

determining the electromagnetic field of the body by superposition using the global multipole expansion and the local multipole expansion for the plurality of subregions.

2. The method according to claim 1, wherein the following steps for determining the electromagnetic field of the body are carried out iteratively until an error measure is of a predetermined small size,  $I = 0$  being taken as an initial condition:

a) calculating the global multipole expansions with global multipole coefficients according to

$$c^g = GI,$$

$c^g$  being a vector made up of the global multipole coefficients of the plurality of subregions,

$I$  being a vector which specifies a given current distribution,

$G$  being a matrix determining the global multipole coefficients in a respective subregion of the plurality

- of subregions for the given current distribution  $I$ ;
- b) calculating the local multipole expansion with local multipole coefficients according to
- $$c^1 = Tc^g,$$
- $c^1$  being a vector made up of the local multipole coefficients of the plurality of subregions,
- $T$  being a translation matrix through which the global multipoles are combined into local multipoles;
- c) determining the electromagnetic field from
- $$ZI = Z' I + Lc^1,$$
- $Z$  denoting an impedance matrix,
- $Z'$  denoting a part of the impedance matrix  $Z$ , representing couplings between the subregions,
- $L$  denoting a matrix for evaluating the local multipole coefficients.

3. The method according to claim 2, wherein an element which has an impedance and which is a component of the subregion of the body is taken into account directly in the matrix  $Z'$  as an impedance.

4. The method according to claim 1, wherein the subregions are of equal size.

5. The method according to claim 1, wherein a size of the subregions is proportional to a distance from an observer region.

6. The method according to claim 1, wherein each subregion of the plurality of subregions is respectively assigned to a zone with uniform physical attribute.

7. The method according to claim 1, wherein a respective subregion of the plurality of subregions is split into up to eight zones.

8. The method according to claim 1, wherein the electromagnetic field is determined for predetermined frequencies.

9. The method according to claim 8, wherein the predetermined frequencies are determined by a minimum frequency and by a maximum frequency, the method being started at the minimum frequency and the electromagnetic field being determined for each frequency, continuing as far as the maximum frequency, with a predetermined step size.

10. The method according to claim 8, wherein the predetermined frequencies are determined by a minimum frequency and by a maximum frequency, the method being started at the maximum frequency and the electromagnetic field being determined for each frequency, continuing as far as the minimum frequency, with a predeterminable step size.

11. The method according to claim 8, in which the predetermined frequencies are determined by a minimum frequency and by a maximum frequency, the method being started at a frequency between the minimum frequency and the maximum frequency, and the electromagnetic field being determined for each frequency,

continuing as far as one of the maximum frequency or the minimum frequency, with a predetermined step size.

a 12. The method according to claim 1, wherein <sup>a</sup>stability <sup>of said body</sup> at low frequencies is ensured by carrying out the global multipole expansions using elements.

13. The method according to claim 1, wherein the electromagnetic compatibility of the body is determined.

14. A computer-aided simulation method for determining an electromagnetic field of a body which has a plurality of subregions and contains a plurality of charges and currents, comprising the steps of:

performing for predetermined frequencies, in each of the plurality of subregions, a global multipole expansion, which represents an effect of charges and currents for distant points in a respective subregion of the plurality of subregions in a multipole expansion, and a local multipole expansion, which represents an effect of charges and currents at points inside the respective subregions of the plurality of subregions in a multipole expansion; and

determining the electromagnetic field of the body for the predetermined frequencies by superposition using the global multipole expansion and the local multipole expansion for the plurality of subregions.

15. The method according to claim 14, wherein the following steps for determining the electromagnetic field of the body are carried out iteratively until an error measure is of a predetermined small size,  $I = 0$  being taken as an initial condition:

- a) calculating the global multipole expansions with global multipole coefficients according to

$$c^g = GI,$$

$c^g$  being a vector made up of the global multipole coefficients of the plurality of subregions,

$I$  being a vector which specifies a given current distribution,

$G$  being a matrix determining the global multipole coefficients in a respective subregion of the plurality of subregions for the given current distribution  $I$ ;

- b) calculating the local multipole expansion with local multipole coefficients according to

$$c^l = Tc^g,$$

$c^l$  being a vector made up of the local multipole coefficients of the plurality of subregions,

$T$  being a translation matrix through which the global multipoles are combined into local multipoles;

- c) determining the electromagnetic field from

$$ZI = Z' I + Lc^l,$$

$Z$  denoting an impedance matrix,

$Z'$  denoting a part of the impedance matrix  $Z$ , representing couplings between the subregions,

$L$  denoting a matrix for evaluating the local multipole coefficients.

16. The method according to claim 14, wherein the predetermined frequencies are determined by a minimum frequency and by a maximum frequency, the method being started at the minimum frequency and the electromagnetic field being determined for each frequency, continuing as far as the maximum frequency, with a predetermined step size.

17. The method according to claim 14, wherein the predetermined frequencies are determined by a minimum frequency and by a maximum frequency, the method being started at the maximum frequency and the electromagnetic field being determined for each frequency, continuing as far as the minimum frequency, with a predeterminable step size.

18. The method according to claim 14, in which the predetermined frequencies are determined by a minimum frequency and by a maximum frequency, the method being started at a frequency between the minimum frequency and the maximum frequency, and the electromagnetic field being determined for each frequency, continuing as far as one of the maximum frequency or the minimum frequency, with a predetermined step size.

19. A computer-aided simulation method for determining an electromagnetic field of a body which has a plurality of subregions and contains a plurality of charges and currents, comprising the steps of:

splitting each subregion of the plurality of subregions into a predetermined number of zones in the range of 2 to 8 zones;

performing, in each of the plurality of subregions, a global multipole expansion using elements for low frequency stability,

the expansion representing, an effect of charges and currents for distant points in a respective subregion of the plurality of subregions in a multipole expansion, and a local multipole expansion, which represents an effect of charges and currents at points inside the respective subregions of the plurality of subregions in a multipole expansion; and

determining the electromagnetic field of the body by superposition using the global multipole expansion and the local multipole expansion for the plurality of subregions.

20. The method according to claim 19, wherein the following steps for determining the electromagnetic field of the body are carried out iteratively until an error measure is of a predetermined small size,  $I = 0$  being taken as an initial condition:

- a) calculating the global multipole expansions with global multipole coefficients according to

$$c^g = GI,$$

$c^g$  being a vector made up of the global multipole coefficients of the plurality of subregions,

$I$  being a vector which specifies a given current distribution,

$G$  being a matrix determining the global multipole coefficients in a respective subregion of the plurality of subregions for the given current distribution  $I$ ;

- b) calculating the local multipole expansion with local multipole coefficients according to

$$c^l = Tc^g,$$

$c^l$  being a vector made up of the local multipole coefficients of the plurality of subregions,

c) determining the electromagnetic field from

$Z$  denoting an impedance matrix,

$L$  denoting a matrix for evaluating the local multipole coefficients.